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Electrical machine 2..... 2014/2015



Sheet (4)

1. A1 ϕ , 25 kVA, 220/440V, 60Hz transformer gave the following test results.
Open circuit test (440V side open): 220V, 9.5A, 650W
Short-circuit test (220V side shorted): 37.5 V, 55 A, 950W
 - (a) Derive the approximate equivalent circuit in per-unit values.
 - (b) Determine the voltage regulation at full load, 0.8 PF lagging.
 - (c) Draw the phasor diagram for condition (b).

2. A1 ϕ , 200kVA, 2100/210V, 60Hz transformer has the following characteristics. The impedance of the high-voltage winding is $0.25+j1.5\Omega$ with the low-voltage winding short-circuited. The admittance (i.e., inverse of impedance) of the low-voltage winding is $0.025-j0.075$ (mhos) with the high-voltage winding open-circuited.
 - (a) Taking the transformer rating as base, determine the base values of power, voltage, current, and impedance for both the high-voltage and low-voltage sides of the transformer.
 - (b) Determine the per-unit value of the equivalent resistance and leakage reactance of the transformer.
 - (c) Determine the per-unit value of the excitation current at rated voltage.
 - (d) Determine the per-unit value of the total power loss in the transformer at full-load output condition

3. A single-phase transformer has an equivalent leakage reactance of 0.04 per unit. The full-load copper loss is 0.015 per unit and the no-load power loss at rated voltage is 0.01pu. The transformer supplies full-load power at rated voltage and 0.85 lagging power factor.
 - (a) Determine the efficiency of the transformer.
 - (b) Determine the voltage regulation.

4. A 1 ϕ , 10 kVA, 7500/250 V, 60 Hz transformer has

$$Z_{eq} = 0.015 + j0.06$$

$$R_c = 60 \text{ pu}$$

$$X_m = 20 \text{ pu}$$

- (a) Determine the equivalent circuit in ohmic values referred to the low-voltage side.
 - (b) The high-voltage winding is connected to a 7500V supply, and a load of $(-5 j)$ is connected to the low-voltage side. Determine the load voltage and load current. Determine the voltage regulation
5. A 24-kVA, 2400/240-V distribution transformer is to be connected as an autotransformer. For each possible combination, determine
- (a) The primary winding voltage.
 - (b) The secondary winding voltage.
 - (c) The ratio of transformation.
 - (d) The nominal rating of the autotransformer.
6. Reconnect the windings of a 1 ϕ , 3kVA, 240/120V, 60Hz transformer so that it can supply a load at 330V from a 110V supply.
- (a) Show the connection.
 - (b) Determine the maximum kVA the reconnected transformer can deliver.
7. A 1 ϕ , 10kVA, 460/120V, 60Hz transformer has an efficiency of 96% when it delivers 9 kW at 0.9 power factor. This transformer is connected as an autotransformer to supply load to a 460V circuit from a 580V source.
- (a) Show the autotransformer connection.
 - (b) Determine the maximum kVA the autotransformer can supply to the 460V circuit.
 - (c) Determine the efficiency of the autotransformer for full load at 0.9 power factor.